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Employment and Population in European Union: Econometric Models and Causality Tests

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Abstract

We analyse the interdependence between non-agrarian employment, real value-added and population in 98 European regions, by means of a pool of data for the period 1985-1995, and in 5 EU countries with a pool for 1961-97. We test causality by means of Hausman´s test in these three equations models. Besides we test causality by means of Granger´s test and with time series of each country for 1961-2000. The main conclusion is that there is some degree of interdependence among the three variable: 1) Population moves towards employment. 2) Production increases with population and with social and institutional factors (human capital and other ones). 3) Employment increases with production and population. The results agree with the Freeman´s conclusions for regional employment and population movements in the USA.

1.- Introduction

This paper is an updated version of the working paper by Aguayo and Guisan(2001) which has not been published on line until now. Besides the main contents of that working paper we have added some data, models and analyses regarding the new circumstances of European Union including a reference to the challenges for employment policies after EU Enlargement of year 2004.

Section 2 presents the estimation of 2 interregional econometric models with data of 98 EU regions in 1985-95, corresponding to the 12 countries of the former European Economic Community. Section 3 presents the application of Hausman test to analyse causality in the interregional models of the previous section. Section 4 presents the results of Granger´s and Hausman´s causality tests apply to time series of 5 European countries. Finally section 5 presents the main conclusions.

2.- Interregional models with interdependence between Employment and Population in 98 European regions

Several authors, as Birg(1981) and Freeman(2001) has pointed out that employment and population are interdependent in many countries, such is the case of the USA, because people moves from one region to another when they need that to get an employment. On the other there are several positive impacts of population on employment because the increase of population generally implies an increase in labour supply and in the demand of goods and services and these variables have at some extent a positive impact on employment. Labour mobility in European Union is not so easy as in the USA, due to the multicultural and multilingual characteristics of Europe, but at some extent this mobility also exists when there are important differences in income per inhabitant and in opportunities of employment among different regions and countries.

Here we present the results of the estimation of two models with interdependence between non-agrarian employment and population in 98 European regions, with data of the years 1985, 1990, and 1995. Regions correspond to the 12 countries of former European Economic Community, EEC: Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, and United Kingdom. The sample size is 196, with 98 observations for dependent variables in year 1990 and the same number in 1995. Estimation method is Two Stages Least Squares, TSLS. Model 1 has two equations and Model 2 has three equations, including besides Lnakm and Popkm, the non agrarian real Value-Added density, Vnakm, also as dependent variable. The list of variables is as follows:

LNAKM = density of non-agrarian labour per square kilometre
VNAKM = density of real non agrarian Value-Added per square kilometre
POPKM = density of population per square kilometre
DX= Increase of variable X in the previous 5 years: DX=X–X(-5)
X5= Lagged value, 5 years lag: X5=X(-5)
PS2 = Percentage of active population with complete second cycle of secondary studies or higher level.

Model 1: two equations

1.1. Employment equation in Model 1

TSLS // Dependent Variable is LNAKM
Sample: 1 196. Included observations: 196
Instrument list: LNAKM5 POPKM5 DVNAKM

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNAKM5	1.044419	0.005398	193.4695	0.0000
D(POPKM)	2.750047	0.290160	9.477697	0.0000
DVNAKM	4.594591	0.789707	5.818095	0.0000

R-squared	0.9964	Mean dependent var	146.88
Adjusted R-squared	0.9964	S.D. dependent var	450.18
S.E. of regression	27.0328	Akaike info criterion	6.61

Sum squared resid	141039.4	Schwarz criterion	6.66
F-statistic	26934.66	Durbin-Watson stat	1.8383

1.2. Population equation in Model 1.

TSLS // Dependent Variable is POPKM
Sample: 1 196. Included observations: 196
Instrument list: LNAKM5 POPKM5 DVNAKM

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPKM5	0.989449	0.001334	741.7757	0.0000
DLNAKM	0.312946	0.035967	8.700873	0.0000

R-squared	0.999819	Mean dependent var	319.1193
Adjusted R-squared	0.999818	S.D. dependent var	745.0211
S.E. of regression	10.05655	Akaike info criterion	4.626600
Sum squared resid	19620.03	Schwarz criterion	4.660050
F-statistic	1069911.	Durbin-Watson stat	1.720114

Model 2: three equations

2.1. Employment equation in Model 2

TSLS // Dependent Variable is LNAKM
Sample: 1 196. Included observations: 196
Instrument list: LNAKM5 POPKM5 VNAKM5 PS2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNAKM5	1.025198	0.005603	182.9894	0.0000
IPOPKM	2.224445	0.172073	12.92731	0.0000
IVNAKM	10.69068	1.299105	8.229270	0.0000

R-squared	0.996097	Mean dependent var	146.8773
Adjusted R-squared	0.996056	S.D. dependent var	450.1765
S.E. of regression	28.27018	Akaike info criterion	6.698803
Sum squared resid	154246.2	Schwarz criterion	6.748978
F-statistic	24669.36	Durbin-Watson stat	1.853174

2.2. Population equation in Model 2

TSLS // Dependent Variable is POPKM
Sample: 1 196. Included observations: 196
Instrument list: LNAKM5 POPKM5 VNAKM5 PS2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPKM5	0.986999	0.001229	803.0908	0.0000
DLNAKM	0.401392	0.028839	13.91820	0.0000

R-squared	0.999799	Mean dependent var	319.1193
Adjusted R-squared	0.999798	S.D. dependent var	745.0211

S.E. of regression	10.59101	Akaike info criterion	4.730163
Sum squared resid	21760.90	Schwarz criterion	4.763614
F-statistic	964777.6	Durbin-Watson stat	1.758651

2.3. Value-Added equation in Model 2.

TSLS // Dependent Variable is VNAKM
Sample: 1 196.Included observations: 196
Instrument list: LNAKM5 POPKM5 VNAKM5 PS2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VNAKM5	0.801410	0.050488	15.87339	0.0000
DPOPKM	0.086029	0.025572	3.364260	0.0009
PS2	12.12682	2.423691	5.003451	0.0000

R-squared	0.987775	Mean dependent var	6.860332
Adjusted R-squared	0.987649	S.D. dependent var	20.70462
S.E. of regression	2.301046	Akaike info criterion	1.681915
Sum squared resid	1021.899	Schwarz criterion	1.732090
F-statistic	7789.039	Durbin-Watson stat	1.861995

We would like to point out the positive effect of human capital on economic development, which agree with the results of previous studies as those of Arranz, Freire and Guisan(2001) for OCDE countries, Guisan, Aguayo and Exposito(2001) and Neira and Guisan(2002) for world development, and other studies. The variable PS2 is only and indicator of several other variables as explained in Guisan, Cancelo, Aguayo and Diaz(2001) and in other studies.

All the explanatory variables in both models have significant coefficients, and the results seem to confirm the existence of interdependence. In the next section we apply some causality tests to the same data.

3. Causality tests with data of 98 European regions in 1990 and 1995.

Causality test in Model 1

We apply Hausman test of causality to the equations of Model 1:

(1.1) LNAKM / LNAKM5 DVNAKM DPOPKM

(1.2) POPKM / POPKM5 DLNAKM

First of all, following the procedure suggested by Nakamura and Nakamura(1981) for the application of the Hausman´s test, we estimated the reduced form of this system, to obtain the estimated values of both endogenous variables: Lnakmf and Popkmf. Afterwards we estimate by least squares, LS, the following expanded equations and we test the significance of parameters α_1 and α_2 :

(3.1) LNAKM=(1)+α_1 DPOPKMF

(3.2) POPKM=(2)+α_2 DLNAKMF

3.1. Estimation of the expanded equation 3.1 for Employment in Model 1

LS // Dependent Variable is LNAKM
Sample: 1 196.Included observations: 196

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNAKM5	1.049028	0.004248	246.9286	0.0000
DVNAKM	4.292150	0.613109	7.000628	0.0000
DPOPKM	1.364868	0.123258	11.07325	0.0000
DPOPKMF	1.870900	0.268881	6.958091	0.0000

R-squared	0.997875	Mean dependent var	146.8773
Adjusted R-squared	0.997842	S.D. dependent var	450.1765
S.E. of regression	20.91490	Akaike info criterion	6.101121
Sum squared resid	83987.18	Schwarz criterion	6.168021
Log likelihood	-872.0218	F-statistic	30049.92
Durbin-Watson stat	1.659889	Prob(F-statistic)	0.000000

3.2. Estimation of the expanded equation 3.2 for Population in Model 1

LS // Dependent Variable is POPKM
Sample: 1 196 .Included observations: 196

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPKM5	0.989028	0.001337	739.6438	0.0000
DLNAKM	0.285547	0.027094	10.53897	0.0000
DLNAKMF	0.042589	0.045169	0.942888	0.3469

R-squared	0.999820	Mean dependent var	319.1193
Adjusted R-squared	0.999818	S.D. dependent var	745.0211
S.E. of regression	10.05139	Akaike info criterion	4.630609
Sum squared resid	19498.87	Schwarz criterion	4.680785
Log likelihood	-728.9117	F-statistic	535564.0
Durbin-Watson stat	1.734630	Prob(F-statistic)	0.000000

The significance of parameter α_1 indicates correlation between DPOPKM and the random shock of equation 3.1, due to the existence of a bilateral contemporaneous relation between DPOPKM and LNAKM. Interdependence is not rejected when α_1 and/or α_2 are different from zero, and thus in this case we accept interdependence with a stronger dependence of Population on Employment, but also, at a lower extent, there is evidence of dependence of Employment on Population.

Causality test in Model 2

We apply Hausman test of causality to the equations of Model 2:

(2.1) LNAKM / LNAKM5 DPOPKM DVNAKM
(2.2) POPKM / POPKM5 DLNAKM
(2.3) VNAKM / VNAKM5 DPOPKM PS2

First of all, following the former procedure we estimate the values of DLNAKMF, DPOPKMF and DVNAKMF by fitting by LS the reduce form of Model 2. Afterwards we estimate by LS the expanded equations suggested by Nakamura and Nakamura(1981), in order to test the null hypothesis for α_1 , α_2 , α_3 and α_4 :

(4.1) LNAKM = (1) + α_1 DPOPKMF+α_2DVNAKM

(4.2) POPKM = (2) + α_2 DLNAKM

(4.3) VNAKM = (3) + α_4 DPOPKMF

4.1. Estimation of the expanded equation 4.1 for Employment in Model 2.

LS // Dependent Variable is LNAKM
Sample: 1 196.Included observations: 196

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNAKM5	1.028604	0.003753	274.0857	0.0000
DPOPKM	0.552584	0.173783	3.179733	0.0017
DVNAKM	3.667972	0.670875	5.467447	0.0000
DPOPKMF	1.800632	0.209334	8.601710	0.0000
DVNAKMF	6.057647	1.107060	5.471834	0.0000

R-squared	0.998351	Mean dependent var	146.8773
Adjusted R-squared	0.998317	S.D. dependent var	450.1765
S.E. of regression	18.46925	Akaike info criterion	5.857394
Sum squared resid	65152.64	Schwarz criterion	5.941019
Log likelihoo	-847.1366	F-statistic	28915.12
Durbin-Watson stat	1.597932	Prob(F-statistic)	0.000000

4.2. Estimation of the expanded equation 4.2 for Population in Model 2

LS // Dependent Variable is POPKM
Sample: 1 196. Included observations: 196

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPKM5	0.986589	0.001021	966.3042	0.0000
DLNAKM	0.111160	0.030808	3.608116	0.0004
DLNAKMF	0.305007	0.039064	7.807840	0.0000

R-squared	0.999862	Mean dependent var	319.1193

Adjusted R-squared	0.999861	S.D. dependent var	745.0211
S.E. of regression	8.782497	Akaike info criterion	4.360709
Sum squared resid	14886.52	Schwarz criterion	4.410884
Log likelihood	-702.4615	F-statistic	701529.6
Durbin-Watson stat	1.768988	Prob(F-statistic)	0.000000

4.3. Estimation of the expanded equation 4.3 for real Value-Added in Model 2

LS // Dependent Variable is VNAKM
Sample: 1 196.Included observations: 196

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VNAKM5	0.685674	0.054867	12.49695	0.0000
PS2	17.82067	2.646001	6.734945	0.0000
DPOPKM	0.056878	0.020753	2.740705	0.0067
DPOPKMF	0.099804	0.035592	2.804089	0.0056

R-squared	0.988261	Mean dependent var	6.860332
Adjusted R-squared	0.988078	S.D. dependent var	20.70462
S.E. of regression	2.260740	Akaike info criterion	1.651581
Sum squared resid	981.3011	Schwarz criterion	1.718481
Log likelihoo	-435.9669	F-statistic	5387.885
Durbin-Watson stat	1.860154	Prob(F-statistic)	0.000000

Given that the parameters α_1, α_2, α_3 y α_4 are significantly different from zero, we can conclude that there is a clear evidence favourable to the hypothesis of interdependence among the three dependent variables of Model 2, as to say the density per square kilometre of non agrarian employment, population and real non value-added of non agrarian sectors.

In the next section we analyse causality by means of Granger´s and Hausman´s test with time series samples of 5 European countries.

4. Causality tests, cointegration and error EC model of Employment and Population

First of all graph 1 shows the evolution of LNAKM and POPKM in Germany, France, Spain, United Kingdom and Italy for the period 1961-1997. This data show that population density depends strongly on their own lagged value and it seems that the increase of the density of employment also has a positive relationship with this variable.

In this section we present a TSLS estimation of model 1 with a panel of data of these five countries for 1961-97, as well as the results of causality tests, cointegration ADF test, and the estimation of an Error Component Model for these European countries. Regarding casuality tests we present the results of Hausman for Model 1, Granger´s for the periods 1961-97 and 1961-2000. The variables have the same meaning that in the previous sections, with the following differences, in this panel of time series, where there is only a 1 year lag instead of a 5 year lag:

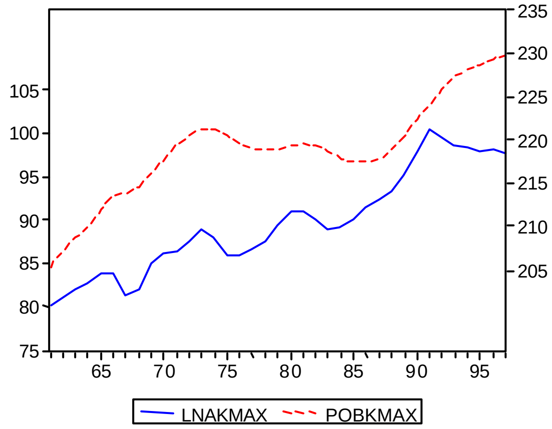
$$D(X) = X(t) – X(t-1)$$

All the analyses show the important positive impact that Employment has on Population. Also wages and income per inhabitant are very important to explain migratory movements among European regions and countries, according to the results show in several studies as Guisan(2004) for 151 European Regions. These effects should be had into account in order to improve economic policies in Europe related with regional development and employment.

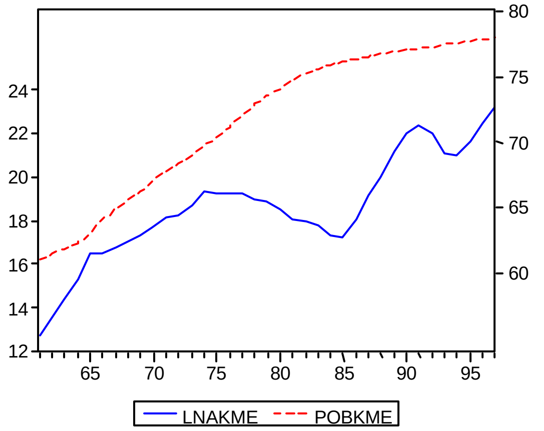
Graph1. Density of Employment and Population per square kilometre, 1961-1997

DENSITY
OF EMPLOYMENT
AND POPULATION

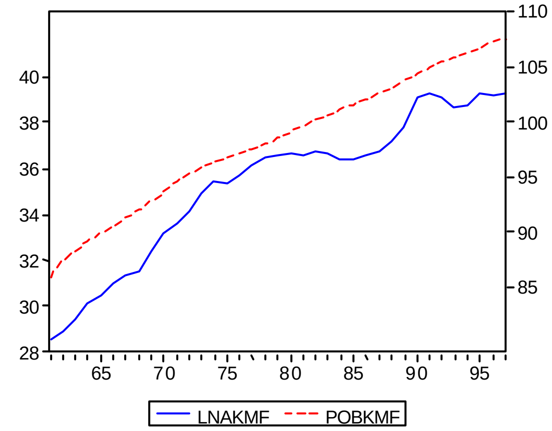
Germany



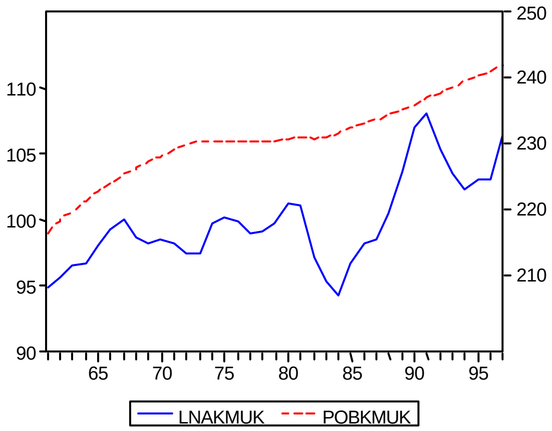
Spain



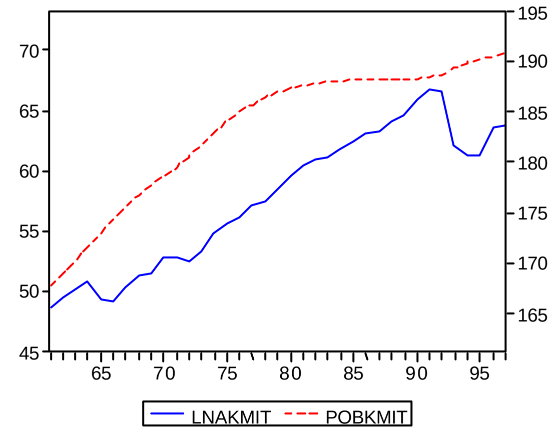
France



United Kingdom



Italy



TSLS estimation and Hausman´s causality test

We consider the following model with a panel of 5 countries for the period 1961-97:

(5.1) LNAKM / LNAKM(-1) D(GDPKM) D(POPKM)

(5.2) POPKM / POPKM(-1) D(LNAKM)

5.1. Equation 5.1 for Employment with a panel of 185 observations

TSLS // Dependent Variable is LNAKM
Sample: 1 185.Included observations: 185
Instrument list: LNAKM1 POPKM1 IGDPKM

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNAKM1	1.001095	0.001889	529.8695	0.0000
IGDPKM	1.382924	2.476449	0.558430	0.5772
IPOPKM	0.434055	0.365878	1.186337	0.2370

R-squared	0.998799	Mean dependent var	60.19558
Adjusted R-squared	0.998785	S.D. dependent var	31.34223
S.E. of regression	1.092331	Akaike info criterion	0.192710
Sum squared resid	217.1599	Schwarz criterion	0.244932
F-statistic	75653.41	Durbin-Watson stat	1.211401

5.2. Equation 5.2 for Population with a panel of 185 observations

TSLS // Dependent Variable is POPKM
Sample: 1 185.Included observations: 185
Instrument list: LNAKM1 POPKM1 IGDPKM

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPKM1	0.999892	0.001351	740.2319	0.0000
ILNAKM	1.385530	0.614284	2.255519	0.0253

R-squared	0.999432	Mean dependent var	160.3922
Adjusted R-squared	0.999428	S.D. dependent var	64.58510
S.E. of regression	1.544039	Akaike info criterion	0.879555
Sum squared resid	436.2824	Schwarz criterion	0.914370
F-statistic	321918.8	Durbin-Watson stat	1.169847

For Hausman´s test, we estimate by LS the following expanded equations:

(6.1) LNAKM=(1)+α_1 D(POPKMF)

(6.2) POPKM=(2)+α_2 D(LNAKMF)

where POPKMF and LNAKMF are the estimated values in the reduced form of system 5.1 and 5.2.

6.1. Estimation of 6.1, expanded equation of Employment

LS // Dependent Variable is LNAKM
Sample: 1 185
Included observations: 185

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNAKM1	0.999631	0.002269	440.5978	0.0000
D(GDPKM)	-1.064283	3.261130	-0.326354	0.7445
D(POPKM)	0.044715	0.181588	0.246246	0.8058
D(POPKMF)	0.865584	0.582784	1.485256	0.1392

R-squared	0.998833	Mean dependent var	60.19558
Adjusted R-squared	0.998814	S.D. dependent var	31.34223
S.E. of regression	1.079545	Akaike info criterion	0.174463
Sum squared resid	210.9404	Schwarz criterion	0.244093
Log likelihood	-274.6415	F-statistic	51637.82
Durbin-Watson stat	1.231825	Prob(F-statistic)	0.000000

6.2. Estimation of 6.2, expanded equation of Population

LS // Dependent Variable is POPKM
Sample: 1 185
Included observations: 185

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPKM1	1.000003	0.000387	2581.167	0.0000
D(LNAKM)	0.007490	0.030426	0.246158	0.8058
D(LNAKMF)	1.320129	0.178900	7.379137	0.0000

R-squared	0.999954	Mean dependent var	160.3922
Adjusted R-squared	0.999953	S.D. dependent var	64.58510
S.E. of regression	0.441974	Akaike info criterion	-1.616926
Sum squared resid	35.55203	Schwarz criterion	-1.564704
Log likelihood	-109.9380	F-statistic	1964443.
Durbin-Watson stat	0.334185	Prob(F-statistic)	0.000000

.

Granger´s Test

Hypothesis:	POPKM does not cause Granger LNAKM		LNAKM does not cause Granger POPKM	
Lags: 1	F-Statistic	Probability	F-Statistic	Probability
GERMANY	0.165	0.686	11.73	0.001
SPAIN	1.432	0.253	2.707	0.062
FRANCE	1.874	0.179	4.787	0.035
UK	1.465	0.234	2.127	0.153

ITALY	4.392	0.043	13.828	0.0007

Hypothesis:	POPKM does not cause Granger LNAKM		LNAKM does not cause Granger POPKM	
Lags: 2	F-Statistic	Probability	F-Statistic	Probability
GERMANY	0.729	0.490	3.358	0.047
SPAIN	2.898	0.069	3.001	0.063
FRANCE	2.484	0.099	0.154	0.857
UK	6.137	0.005	0.264	0.769
ITALY	7.686	0.002	4.096	0.026

Hypothesis:	POPKM does not cause Granger LNAKM		LNAKM does not cause Granger POPKM	
Lags: 3	F-Statistic	Probability	F-Statistic	Probability
GERMANY	0.945	0.431	1.142	0.349
SPAIN	1.432	0.253	2.707	0.063
FRANCE	1.206	0.324	0.519	0.672
UK	2.962	0.048	0.628	0.602
ITALY	4.787	0.008	1.457	0.247

Hypothesis:	POPKM does not cause Granger LNAKM		LNAKM does not cause Granger POPKM	
Lags: 4	F-Statistic	Probability	F-Statistic	Probability
GERMANY	0.888	0.485	1.009	0.421
SPAIN	1.159	0.349	2.169	0.098
FRANCE	1.050	0.399	3.153	0.029
UK	1.887	0.140	0.476	0.752
ITALY	4.002	0.012	1.136	0.362

Cointegration analysis

(7.1) LNAKM/LNAKM(-1) D(GDPKM) D(POPKM)
(7.2) POPKM/C POPKM(-1) D(LNAKM)

Test ADF

	(C, 1) Equation 7.1		(N, 1) Equation 7.2	
País	MCO	MC2E	MCO	MC2E
Germany	-5.43	-5.18	-2.34	-2.34
Spain	-3.92	-3.72	-2.92	-2.89
France	-4.79	-4.99	-3.97	-4.03
UK	-4.05	-3.92	-1.34	-2.74

Italy	-4.17	-4.19	-2.20	-3.17
	Critial Values, tables of McKinnon			
Al 1%	-3.62		-2.62	
Al 5%	-2.94		-1.95	
Al 10%	-2.61		-1.62	

EC Model

Long term equation for Employment

	GDPKM	POPKM	TI
Germany	4.15 (13.12)	0.34 (64.40)	--
Spain	4.87 (4.47)	0.21 (18.81)	--
France	2.62 (8.73)	0.31 (59.64)	--
UK	7.68 (2.28)	0.53 (12.89)	-0.59 (-2.37)
Italy	4.81 (12.73)	0.24 (42.12)	--

Short term equation for Employment

	D(LNAKM(-1))	D(GDPKM(-1))	D(POPKM(-1))	C	UF(-1)
Germany	0.19 (1.10)	5.19 (1.70)	0.07 (0.23)	--	-0.18 (-1.00)
Spain	0.39 (2.16)	12.68 (2.27)	-0.24 (-1.29)	--	0.002 (1.28)
France	0.11 (0.58)	6.17 (2.45)	0.01 (0.07)	--	-0.15 (-1.95)
UK	0.52 (4.42)	7.99 (1.88)	0.41 (1.17)	-0.66 (-1.81)	-0.29 (-2.28)
Italy	0.16 (1.05)	8.07 (2.89)	-0.34 (-1.26)	--	-0.27 (-2.82)

Long term equation for Population

	LNAKM
Germany	2.43 (136.2)
Spain	3.81 (76.32)
France	2.77 (182.5)

UK	2.31 (258.05)
Italy	3.15 (89.88)

Short term equation for Population

	D(POPKM(-1))	D(LNAKM(-1))	UF(-1)
Germany	0.83 (11.48)	0.10 (1.67)	0.001 (0.18)
Spain	0.93 (23.09)	0.08 (2.25)	-0.002 (-4.46)
France	0.92 (24.94)	0.02 (0.42)	-0.006 (-1.19)
UK	0.93 (20.45)	-0.01 (-0.36)	0.006 (0.79)
Italy	0.99 (28.34)	0.008 (0.46)	-0.002 (-1.28)

Finally we present the results of Granger´s causality tests for these 5 European countries in the period 1960-2000, which show a stronger dependence of Population on Employment also the reverse relationship also is significant in several countries.

Pairwise Granger Causality Tests
Sample: 1960 2000. Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
GDP90E does not Granger Cause LNAE	39	7.40831	0.00214
LNAE does not Granger Cause GDP90E		1.94538	0.15852

Pairwise Granger Causality Tests
Sample: 1960 2000. Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
GDP90AX does not Granger Cause LNAAX	39	9.89458	0.00041
LNAAX does not Granger Cause GDP90AX		3.39559	0.04524

Pairwise Granger Causality Tests
Sample: 1960 2000. Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability

GDP90F does not Granger Cause LNAF	39	7.37813	0.00218
LNAF does not Granger Cause GDP90F		1.89119	0.16643

Pairwise Granger Causality Tests
Sample: 1960 2000. Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
GDP90UK does not Granger Cause LNAUK	39	16.7692	8.6E-06
LNAUK does not Granger Cause GDP90UK		5.92534	0.00620

Pairwise Granger Causality Tests
Sample: 1960 2000. Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
GDP90IT does not Granger Cause LNAIT	39	5.66991	0.00750
LNAIT does not Granger Cause GDP90IT		1.42622	0.25422

5. Conclusions

. The main conclusion is that there is some degree of interdependence among the three variable: 1) Population moves towards employment. 2) Production increases with population and with social and institutional factors (human capital and other ones). 3) Employment increases with production and population. The results agree with the Freeman´s conclusions for regional employment and population movements in the USA.

It is very important to improve employment policies in European Union both at national and regional level, in order to foster an harmonic development in all areas of EU.

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[1]Information about these documents can be found at ideas.repec.org
[2]Information about these documents can be found at www.usc.es/economet/eaa.htm

Annex: Regional data of 151 regions of 25 European countries

Regional Ratios of Population, Value-Added and Employment, EU 25, 1995-200

obs	Región	RPOP95	RPOP00	RQ95PP	RQ00PP	RLT95	RLT00
1	Bruxelles	0.21	0.21	0.54	0.51	0.18	0.18
2	Vlaams	1.31	1.32	1.61	1.53	1.31	1.35
3	Wallone	0.74	0.74	0.68	0.64	0.63	0.66
4	Denmark	1.17	1.18	1.53	1.54	1.45	1.44
5	Baden	2.30	2.32	3.13	3.12	2.64	2.59
6	Bayern	2.67	2.70	3.67	3.68	3.19	3.10
7	Berlin	0.78	0.75	0.96	0.79	0.89	0.78
8	Brand	0.57	0.58	0.45	0.44	0.61	0.60
9	Bremen	0.15	0.15	0.24	0.23	0.16	0.15
10	Hamb	0.38	0.38	0.78	0.76	0.44	0.42
11	Hessen	1.34	1.34	1.98	1.91	1.48	1.45
12	Mecklen	0.41	0.39	0.32	0.30	0.45	0.41
13	N.Sachen	1.73	1.75	1.94	1.85	1.83	1.81
14	Nordhrhein-Westfalia	3.98	3.98	5.04	4.76	4.07	4.02
15	Rheninland	0.88	0.89	1.00	0.95	0.94	0.96
16	Saarland	0.24	0.24	0.28	0.25	0.23	0.24
17	Sachsen	1.03	0.98	0.83	0.76	1.08	1.00
18	Sachnsen-A.	0.62	0.58	0.46	0.44	0.65	0.56
19	Schleswig	0.61	0.62	0.71	0.65	0.68	0.65
20	Thúrin	0.56	0.54	0.42	0.41	0.61	0.58
21	Voreia	0.75	0.76	0.51	0.53	0.71	0.66
22	Kentriki	0.58	0.59	0.38	0.38	0.44	0.41
23	Attiki	0.78	0.76	0.65	0.65	0.78	0.83
24	Nisia-Kriti	0.22	0.23	0.16	0.17	0.20	0.20
25	Galicia	0.61	0.60	0.43	0.43	0.51	0.53
26	Asturias	0.24	0.23	0.18	0.18	0.17	0.18
27	Cantabria	0.12	0.12	0.10	0.10	0.09	0.09
28	Pais Vasco	0.47	0.46	0.48	0.51	0.38	0.43
29	Navarra	0.12	0.12	0.13	0.14	0.10	0.11
30	Rioja	0.06	0.06	0.06	0.06	0.05	0.05
31	Aragon	0.26	0.26	0.25	0.25	0.22	0.24

32	Madrid	1.12	1.14	1.28	1.38	0.89	1.06
33	Castilla y León	0.56	0.55	0.46	0.46	0.42	0.46
34	Castilla-La Mancha	0.38	0.38	0.27	0.28	0.26	0.31
35	Extremadura	0.24	0.24	0.13	0.14	0.15	0.18
36	Cataluña	1.36	1.37	1.44	1.49	1.18	1.31
37	C.Valenciana	0.87	0.89	0.72	0.78	0.70	0.82
38	Baleares	0.16	0.17	0.17	0.19	0.15	0.17
39	Andalucia	1.59	1.60	1.02	1.08	0.98	1.16
40	Murcia	0.24	0.25	0.17	0.19	0.18	0.22
41	Canarias	0.35	0.37	0.29	0.32	0.27	0.32
42	Ille de France	2.46	2.43	4.36	4.24	2.63	2.67
43	Champagne	0.30	0.30	0.32	0.31	0.27	0.25
44	Picardie	0.42	0.41	0.40	0.37	0.36	0.37
45	H.Normandie	0.40	0.40	0.43	0.41	0.39	0.40
46	Centre	0.54	0.54	0.58	0.54	0.53	0.52
47	B.Normandie	0.32	0.32	0.31	0.30	0.26	0.26
48	Bourgogne	0.36	0.36	0.38	0.36	0.34	0.33
49	Nord-Pas-de-Calais	0.89	0.89	0.82	0.79	0.69	0.75
50	Lorrain	0.52	0.51	0.51	0.47	0.47	0.50
51	Alsace	0.38	0.39	0.46	0.44	0.38	0.41
52	Franche-C.	0.25	0.25	0.25	0.24	0.23	0.24
53	Pays de Loire	0.70	0.72	0.71	0.71	0.70	0.72
54	Bretagne	0.64	0.65	0.61	0.61	0.62	0.62
55	Poitou	0.36	0.37	0.35	0.33	0.35	0.33
56	Aquitaine	0.64	0.65	0.66	0.65	0.62	0.62
57	Midi-Pyrennees	0.56	0.57	0.57	0.55	0.51	0.56
58	Limousin	0.16	0.16	0.15	0.14	0.14	0.15
59	Rhône-Alps	1.25	1.26	1.45	1.43	1.26	1.23
60	Auvergne	0.29	0.29	0.28	0.28	0.27	0.26
61	Languedoc-Rousillon	0.50	0.51	0.44	0.44	0.43	0.40
62	Provence	0.99	1.01	1.05	1.01	0.82	0.82
63	Corse	0.06	0.06	0.05	0.05	0.03	0.03
64	Ireland	0.80	0.84	0.83	1.07	0.70	0.88
65	Piemonte	0.96	0.95	1.30	1.25	0.94	0.94
66	V.Aosta	0.03	0.03	0.04	0.04	0.03	0.03
67	Liguria	0.37	0.36	0.44	0.43	0.33	0.31
68	Lombardia	1.99	2.02	3.04	2.98	2.03	2.05
69	Trentino-A.A.	0.20	0.21	0.31	0.31	0.21	0.22
70	Veneto	0.99	1.00	1.34	1.31	0.99	1.02
71	Friuli-V.G.	0.27	0.26	0.35	0.33	0.25	0.25
72	Emilia-R.	0.88	0.89	1.29	1.26	0.92	0.92
73	Toscana	0.79	0.78	0.98	0.98	0.76	0.75
74	Umbria	0.18	0.19	0.21	0.21	0.17	0.17
75	Marche	0.32	0.32	0.37	0.36	0.31	0.31
76	Lazio	1.16	1.17	1.51	1.46	1.00	1.01
77	Abruzzo	0.28	0.28	0.28	0.26	0.25	0.24
78	Molise	0.07	0.07	0.06	0.06	0.06	0.06
79	Campania	1.29	1.28	0.93	0.92	0.82	0.83
80	Puglia	0.91	0.90	0.67	0.67	0.64	0.64
81	Basilicata	0.14	0.13	0.11	0.11	0.10	0.10
82	Calabria	0.46	0.45	0.31	0.31	0.31	0.28
83	Sicilia	1.14	1.12	0.83	0.81	0.72	0.72
84	Sardegna	0.37	0.36	0.31	0.30	0.27	0.27
85	Luxembourg	0.09	0.10	0.17	0.21	0.09	0.10

86	Noord-Ne	0.36	0.37	0.42	0.41	0.37	0.39
87	Oost-Ne	0.71	0.74	0.74	0.76	0.78	0.81
88	West-Ne	1.62	1.64	2.14	2.23	1.79	1.84
89	Zuid-Ne	0.76	0.78	0.87	0.90	0.84	0.87
90	Ost-Ost	0.76	0.76	1.00	1.03	0.89	0.86
91	Sud-Ost	0.39	0.39	0.41	0.41	0.81	0.78
92	West-Ost	0.65	0.65	0.79	0.82	0.39	0.38
93	Norte	0.79	0.80	0.52	0.50	0.89	0.94
94	Centro	0.39	0.39	0.25	0.23	0.46	0.51
95	Lisboa e Val Tejo	0.75	0.76	0.76	0.76	0.82	0.84
96	Alentejo	0.12	0.12	0.08	0.07	0.12	0.12
97	Algarve	0.08	0.08	0.06	0.06	0.08	0.09
98	Açores	0.05	0.05	0.03	0.03	0.05	0.05
99	Madeira	0.06	0.05	0.04	0.04	0.06	0.06
100	Finland	1.14	1.15	1.22	1.31	1.19	1.25
101	Sweden	1.97	1.96	2.32	2.30	2.22	2.21
102	North East	0.58	0.57	0.52	0.49	0.59	0.57
103	North West	1.54	1.53	1.48	1.47	1.63	1.65
104	York+Humb	1.12	1.12	1.06	1.09	1.24	1.23
105	East Midlands	0.92	0.93	0.92	0.96	1.06	1.07
106	West Midlands	1.19	1.19	1.18	1.20	1.31	1.29
107	Eastern	1.17	1.20	1.26	1.38	1.40	1.42
108	London	1.57	1.62	2.40	2.61	1.71	1.79
109	South East	1.75	1.80	1.95	2.18	2.09	2.17
110	South West	1.08	1.10	1.07	1.10	1.22	1.26
111	Wales	0.65	0.65	0.58	0.58	0.66	0.66
112	Scotland	1.15	1.13	1.25	1.21	1.27	1.23
113	N. Ireland	0.37	0.38	0.32	0.32	0.35	0.36
114	Cyprus	0.16	0.15	0.15	0.13	0.19	0.19
115	Praha	0.27	0.26	0.34	0.35	0.35	0.32
116	Stred. Cechy	0.25	0.25	0.13	0.13	0.31	0.28
117	Jihozapad	0.26	0.26	0.17	0.15	0.33	0.30
118	Severoza	0.25	0.25	0.16	0.13	0.30	0.27
119	Severovy	0.33	0.33	0.20	0.17	0.41	0.37
120	Jihovy	0.37	0.37	0.23	0.20	0.44	0.40
121	Sted. Mora	0.28	0.27	0.16	0.14	0.32	0.29
122	Moravsko	0.29	0.28	0.19	0.15	0.31	0.28
123	Estonia	0.32	0.30	0.12	0.13	0.39	0.35
124	Ko-Magy	0.65	0.64	0.47	0.53	0.63	0.63
125	Ko-Duna	0.25	0.25	0.11	0.14	0.25	0.25
126	Nyugat	0.22	0.22	0.12	0.14	0.23	0.23
127	Del-Duna	0.22	0.22	0.09	0.09	0.19	0.19
128	Es-Magy	0.29	0.29	0.11	0.10	0.22	0.22
129	Es-Alfo	0.35	0.34	0.12	0.12	0.27	0.27
130	Del-Alfo	0.31	0.30	0.13	0.12	0.27	0.27
131	Lithuania	0.83	0.78	0.29	0.30	0.86	0.82
132	Letonia	0.57	0.53	0.15	0.18	0.62	0.59
133	Malta	0.08	0.09	0.05	0.05	0.08	0.07
134	Dolnoslaskie	0.67	0.66	0.26	0.29	0.55	0.55
135	Kujawsko-Pomorskie	0.47	0.46	0.18	0.18	0.42	0.41
136	Lubelskie	0.50	0.49	0.15	0.14	0.53	0.47
137	Lubuskie	0.23	0.23	0.08	0.09	0.19	0.19
138	Lodzkie	0.60	0.59	0.21	0.22	0.59	0.53
139	Malopolskie	0.71	0.71	0.24	0.27	0.73	0.71

140	Mazowieckie	1.13	1.12	0.54	0.73	1.26	1.11
141	Opolskie	0.24	0.24	0.09	0.09	0.21	0.22
142	Podkarpackie	0.47	0.47	0.14	0.14	0.51	0.43
143	Podlaskie	0.27	0.27	0.08	0.09	0.27	0.26
144	Promorskie	0.48	0.49	0.18	0.21	0.41	0.44
145	Slaskie	1.10	1.07	0.51	0.51	1.00	0.91
146	Swietokrzyskie	0.30	0.29	0.09	0.10	0.33	0.24
147	Warminsko-Mazurskie	0.32	0.32	0.10	0.10	0.27	0.27
148	Wielkopolskie	0.75	0.74	0.28	0.34	0.72	0.68
149	Zachodniopomorskie	0.39	0.38	0.15	0.16	0.33	0.34
150	Slovenia	0.45	0.44	0.31	0.33	0.52	0.50
151	Slovakia	1.20	1.20	0.61	0.60	1.37	1.27